

## CLAIMS

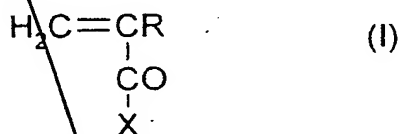
1. Use of a polymer comprising water-soluble units and units with an LCST, the units with an LCST having in water a demixing temperature of from 5 to 40°C at a concentration of 1% by mass in water, to lower the surface tension or the interface tension of water.
2. Use according to Claim 1, in which the lowering of the surface tension or of the interface tension of water is of at least 15 mN/m for a concentration of polymer in water of 0.1% by mass in the temperature range from 5 to 80°C.
3. Use according to Claim 1, in which the lowering of the surface tension or of the interface tension of water is of at least 20 mN/m for a concentration of polymer in water of 0.1% by mass when the temperature is higher than the demixing temperature of the units with an LCST at this concentration.
4. Use of a polymer comprising water-soluble units and units with an LCST, the units with an LCST having in water a demixing temperature of from 5 to 40°C at a concentration of 1% by mass in water, to manufacture a foam.
5. Use of a polymer comprising water-soluble units and units with an LCST, the units with an LCST having in water a demixing temperature of from 5 to 40°C at a concentration of 1% by mass in water, to manufacture a foam, also

comprising a foaming surfactant at a concentration of less than or equal to 5% by mass.

- Lower Critical  
Solution Temp.
- 5 6. Use of a polymer comprising water-soluble units and units with an LCST, the units with an LCST having in water a demixing temperature of from 5 to 40°C at a concentration of 1% by mass in water, to manufacture an emulsion free of additional emulsifying surfactant or
- 10 containing an additional emulsifying surfactant at a concentration of less than or equal to 1% by mass.
- 15 7. Foaming composition comprising an aqueous phase containing a polymer comprising water-soluble units and units with an LCST, the units with an LCST having in water a demixing temperature of from 5 to 40°C at a
- 20 concentration of 1% by mass in water.
- 25 8. Foaming composition according to Claim 7, in which the polymer is in the form of a block polymer comprising water-soluble units alternating with units with an LCST, or in the form of a grafted polymer whose backbone is formed from water-soluble units and which bears grafts consisting of units with an LCST, this structure possibly being partially
- 30 crosslinked, or alternatively in the form of a grafted polymer whose backbone is formed from units with an LCST and which bears grafts consisting of water-soluble units, this structure possibly being partially
- 35 crosslinked.

9. Foaming composition according to either of Claims 7 and 8, in which the water-soluble units are obtained by free-radical polymerization of at least one monomer chosen from:

- (meth)acrylic acid;
- vinyl monomers of formula (I) below:



in which:

- R is chosen from H, -CH<sub>3</sub>, -C<sub>2</sub>H<sub>5</sub> or -C<sub>3</sub>H<sub>7</sub>, and
- X is chosen from:
  - alkyl oxides of -OR' type in which R' is a linear or branched, saturated or unsaturated hydrocarbon radical containing from 1 to 6 carbon atoms, optionally substituted with at least one halogen atom (iodine, bromine, chlorine or fluorine);
  - a sulphonic (-SO<sub>3</sub><sup>-</sup>), sulphate (-SO<sub>4</sub><sup>-</sup>), phosphate (-PO<sub>4</sub>H<sub>2</sub>);
  - hydroxyl (-OH);
  - primary amine (-NH<sub>2</sub>);
  - secondary amine (-NHR<sub>1</sub>), tertiary amine (-NR<sub>1</sub>R<sub>2</sub>) or quaternary amine (-N<sup>+</sup>R<sub>1</sub>R<sub>2</sub>R<sub>3</sub>) group with R<sub>1</sub>, R<sub>2</sub> and R<sub>3</sub> being, independently of each other, a linear or branched, saturated or unsaturated hydrocarbon radical containing 1 to 6 carbon atoms, with the proviso that the sum of the carbon atoms of R' + R<sub>1</sub> + R<sub>2</sub> + R<sub>3</sub> does not exceed 7; and

- 5        -  $\text{-NH}_2$ ,  $\text{-NHR}_4$  and  $\text{-NR}_4\text{R}_5$  groups in which  $\text{R}_4$   
and  $\text{R}_5$  are, independently of each other,  
linear or branched, saturated or  
unsaturated hydrocarbon radicals  
containing 1 to 6 carbon atoms, with the  
proviso that the total number of carbon  
atoms in  $\text{R}_4 + \text{R}_5$  does not exceed 7, the  
said  $\text{R}_4$  and  $\text{R}_5$  optionally being  
substituted with a halogen atom (iodine,  
10       bromine, chlorine or fluorine); a  
hydroxyl ( $\text{-OH}$ ); sulphonic ( $\text{-SO}_3^-$ ),  
sulphate ( $\text{-SO}_4^-$ ); phosphate ( $\text{-PO}_4\text{H}_2$ );  
primary amine ( $\text{-NH}_2$ ); secondary amine ( $\text{-NHR}_1$ ),  
tertiary amine ( $\text{-NR}_1\text{R}_2$ ) and/or  
15       quaternary amine ( $\text{-N}^+\text{R}_1\text{R}_2\text{R}_3$ ) group with  
 $\text{R}_1$ ,  $\text{R}_2$  and  $\text{R}_3$  being, independently of  
each other, a linear or branched,  
saturated or unsaturated hydrocarbon  
radical containing 1 to 6 carbon atoms,  
20       with the proviso that the sum of the  
carbon atoms of  $\text{R}_4 + \text{R}_5 + \text{R}_1 + \text{R}_2 + \text{R}_3$   
does not exceed 7;
- maleic anhydride;
  - itaconic acid;
  - 25       - vinyl alcohol of formula  $\text{CH}_2=\text{CHOH}$ ;
  - vinyl acetate of formula  $\text{CH}_2=\text{CH}-\text{OCOCH}_3$ ;
  - N-vinyl lactams such as N-vinylpyrrolidone,  
N-vinylcaprolactam and N-butyrolactam;
  - vinyl ethers of formula  $\text{CH}_2=\text{CHOR}_6$  in which  
30        $\text{R}_6$  is a linear or branched, saturated or  
unsaturated hydrocarbon radical containing  
from 1 to 6 carbon atoms;
  - water-soluble styrene derivatives,  
especially styrene sulphonate;
  - 35       - dimethyldiallylammonium chloride; and

- vinylacetamide.

10. Foaming composition according to either of Claims 7 and 8, in which the water-soluble units consist totally or partially of one or more of the following components:

- water-soluble polyurethanes,
- xanthan gum,
- 10 - alginates and derivatives thereof such as propylene glycol alginate,
- cellulose derivatives and especially carboxymethylcellulose, hydroxypropylcellulose,
- 15 hydroxyethylcellulose and quaternized hydroxyethylcellulose,
- galactomannans and derivatives thereof such as konjac gum, guar gum, hydroxypropylguar, hydroxypropylguar modified with sodium
- 20 methylcarboxylate groups, and hydroxypropyltrimethylammonium guar chloride, and
- polyethyleneimine.

25 11. Foaming composition according to any one of Claims 7 to 10, in which the water-soluble units have a molar mass ranging from 1000 g/mol to 5 000 000 g/mol when they constitute the water-soluble backbone of a

30 grafted polymer, or a molar mass ranging from 500 g/mol to 100 000 g/mol when they constitute one block of a multiblock polymer or when they constitute the grafts of a

35 grafted polymer.

12. Foaming composition according to any one of Claims 7 to 11, in which the units with an LCST consist of one or more of the following polymers:

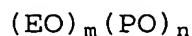
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- polyethers such as polyethylene oxide (PEO), polypropylene oxide (PPO) and random copolymers of ethylene oxide (EO) and of propylene oxide (PO),
  - 10 - polyvinyl methyl ethers,
  - polymeric N-substituted acrylamide derivatives such as poly-N-isopropylacrylamide, poly-N-ethylacrylamide and copolymers of N-isopropylacrylamide or
  - 15 of N-ethylacrylamide and of a vinyl monomer corresponding to formula (I) given in Claim 9, or of a monomer chosen from maleic anhydride, itaconic acid, vinylpyrrolidone, styrene and its derivatives,
  - 20 dimethyldiallylammonium chloride, vinylacetamide, vinyl ethers and vinyl acetate derivatives; and
  - polyvinylcaprolactam and copolymers of vinylcaprolactam and of a vinyl monomer
  - 25 corresponding to formula (I) given in Claim 9, or of a monomer chosen from maleic anhydride, itaconic acid, vinylpyrrolidone, styrene and its derivatives,
  - 30 dimethyldiallylammonium chloride, vinylacetamide, vinyl ethers and vinyl acetate derivatives.

13. Foaming composition according to any one of Claims 7 to 11, in which the units with an LCST consist of polypropylene oxides of

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formula  $(\text{PPO})_n$  with  $n$  being an integer from 10 to 50, or random copolymers of ethylene oxide (EO) and of propylene oxide (PO), represented by the formula:

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in which  $m$  is an integer ranging from 1 to 40 and preferably from 2 to 20, and  $n$  is an integer ranging from 10 to 60 and preferably from 20 to 50.

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14. Foaming composition according to Claim 13, in which the molar mass of the units with an LCST is from 500 to 5300 g/mol and preferably from 1500 to 4000 g/mol.

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15. Foaming composition according to Claim 12, in which the units with an LCST consist of poly-N-isopropylamide or poly-N-ethylacrylamide or a copolymer of N-isopropylacrylamide or of N-ethylacrylamide and of a monomer corresponding to formula (I) given in Claim 9, or of a monomer chosen from maleic anhydride, itaconic acid, vinylpyrrolidone, styrene and its derivatives, dimethyldiallylammonium chloride, vinylacetamide, vinyl alcohol, vinyl acetate, vinyl ethers and vinyl acetate derivatives.

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16. Foaming composition according to Claim 15, in which the molar mass of the units with an LCST is from 1000 g/mol to 500 000 g/mol and preferably from 2000 to 50 000 g/mol.

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17. Foaming composition according to any one of Claims 7 to 11, in which the units with an LCST consist of a polyvinylcaprolactam or a copolymer of vinylcaprolactam and of a vinyl monomer corresponding to formula (I) given in Claim 9, or of a monomer chosen from maleic anhydride, itaconic acid, vinylpyrrolidone, styrene and its derivatives, dimethyldiallylammonium chloride, vinylacetamide, vinyl alcohol, vinyl acetate, vinyl ethers and vinyl acetate derivatives.
18. Foaming composition according to Claim 17, in which the molar mass of the units with an LCST is from 1000 to 500 000 g/mol and preferably from 2000 to 50 000 g/mol.
19. Foaming composition according to any one of Claims 7 to 18, in which the proportion by mass of the units with an LCST of the polymer is from 5 to 70%, preferably from 20 to 65% and better still from 30 to 60% relative to the polymer.
20. Foaming composition according to any one of Claims 7 to 19, in which the demixing temperature of the units with an LCST is from 5 to 40°C for a concentration of the units with an LCST in water of 1% by mass.
21. Foaming composition according to any one of Claims 7 to 20, in which the concentration by mass of polymer in the aqueous phase is less than or equal to 5% and preferably from 0.01% to 5%.



22. Foaming composition according to any one Claims 7 to 21, in which the aqueous phase also comprises a foaming surfactant in a concentration not exceeding 5% by mass.
23. Oil-in-water emulsion comprising an aqueous phase and an oily phase dispersed in the aqueous phase, in which the aqueous phase comprises a polymer comprising water-soluble units and units with an LCST, the units with an LCST having in water a demixing temperature of from 5 to 40°C at a concentration of 1% by mass in water.
24. Water-in-oil-in-water emulsion comprising a water-in-oil emulsion dispersed in an outer aqueous phase, in which the outer aqueous phase comprises a polymer comprising water-soluble units and units with an LCST, the units with an LCST having in water a demixing temperature of from 5 to 40°C at a concentration of 1% by mass in water.
25. Emulsion according to Claim 23 or 24, in which the polymer is in the form of a block polymer comprising water-soluble units alternating with units with an LCST, or in the form of a grafted polymer whose backbone is formed from water-soluble units and which bears grafts consisting of units with an LCST, this structure possibly being partially crosslinked, or alternatively in the form of a grafted polymer whose backbone is formed from units with an LCST and which bears grafts

consisting of water-soluble units, this structure possibly being partially crosslinked.

- 5 26. Emulsion according to any one of Claims 23 to 25, in which the water-soluble units are obtained by free-radical polymerization of at least one monomer chosen from:

- 10 - (meth)acrylic acid;  
- vinyl monomers of formula (I) below:



15 in which:

- R is chosen from H, -CH<sub>3</sub>, -C<sub>2</sub>H<sub>5</sub> or -C<sub>3</sub>H<sub>7</sub>, and
- X is chosen from:
  - alkyl oxides of -OR' type in which R' is a linear or branched, saturated or
  - 20 unsaturated hydrocarbon radical containing from 1 to 6 carbon atoms, optionally substituted with at least one halogen atom (iodine, bromine, chlorine or fluorine); a sulphonic (-SO<sub>3</sub><sup>-</sup>),
  - 25 sulphate (-SO<sub>4</sub><sup>-</sup>), phosphate (-PO<sub>4</sub>H<sub>2</sub>); hydroxyl (-OH); primary amine (-NH<sub>2</sub>); secondary amine (-NHR<sub>1</sub>), tertiary amine (-NR<sub>1</sub>R<sub>2</sub>) or quaternary amine (-N<sup>+</sup>R<sub>1</sub>R<sub>2</sub>R<sub>3</sub>)
  - 30 group with R<sub>1</sub>, R<sub>2</sub> and R<sub>3</sub> being, independently of each other, a linear or branched, saturated or unsaturated hydrocarbon radical containing 1 to 6 carbon atoms, with the proviso that the

- sum of the carbon atoms of  $R_4 + R_1 + R_2 + R_3$  does not exceed 7; and
- 5 -  $-NH_2$ ,  $-NHR_4$  and  $-NR_5$  groups in which  $R_4$  and  $R_5$  are, independently of each other, linear or branched, saturated or unsaturated hydrocarbon radicals containing 1 to 6 carbon atoms, with the proviso that the total number of carbon atoms in  $R_4 + R_5$  does not exceed 7, the
- 10 said  $R_4$  and  $R_5$  optionally being substituted with a halogen atom (iodine, bromine, chlorine or fluorine); a hydroxyl ( $-OH$ ); sulphonic ( $-SO_3^-$ ), sulphate ( $-SO_4^-$ ); phosphate ( $-PO_4H_2$ );
- 15 primary amine ( $-NH_2$ ); secondary amine ( $-NHR_1$ ), tertiary amine ( $-NR_1R_2$ ) and/or quaternary amine ( $-N^+R_1R_2R_3$ ) group with  $R_1$ ,  $R_2$  and  $R_3$  being, independently of each other, a linear or branched,
- 20 saturated or unsaturated hydrocarbon radical containing 1 to 6 carbon atoms, with the proviso that the sum of the carbon atoms of  $R_4 + R_5 + R_1 + R_2 + R_3$  does not exceed 7;
- 25 - maleic anhydride;
- itaconic acid;
- vinyl alcohol of formula  $CH_2=CHOH$ ;
- vinyl acetate of formula  $CH_2=CH-OCOCH_3$ ;
- N-vinyl lactams such as N-vinylpyrrolidone,
- 30 N-vinylcaprolactam and N-butyrolactam;
- vinyl ethers of formula  $CH_2=CHOR$  in which  $R_6$  is a linear or branched, saturated or unsaturated hydrocarbon radical containing from 1 to 6 carbon atoms;

- water-soluble styrene derivatives, especially styrene sulphonate;
- dimethyldiallylammonium chloride; and
- vinylacetamide.

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27. Emulsion according to any one of Claims 23 to 25, in which the water-soluble units consist totally or partially of one or more of the following components:

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- water-soluble polyurethanes,
- xanthan gum,
- alginates and derivatives thereof such as propylene glycol alginate,
- cellulose derivatives and especially carboxymethylcellulose, hydroxypropylcellulose, hydroxyethylcellulose and quaternized hydroxyethylcellulose,
- galactomannans and derivatives thereof such as konjac gum, guar gum, hydroxypropylguar, hydroxypropylguar modified with sodium methylcarboxylate groups, and hydroxypropyltrimethylammonium guar chloride, and
- polyethyleneimine.

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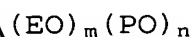
28. Emulsion according to any one of Claims 23 to 27, in which the water-soluble units have a molar mass ranging from 1000 g/mol to 5 000 000 g/mol when they constitute the water-soluble backbone of a grafted polymer, or a molar mass ranging from 500 g/mol to 100 000 g/mol when they constitute one block

of a multiblock polymer or when they constitute the grafts of a grafted polymer.

29. Emulsion according to any one of Claims 23 to 28, in which the units with an LCST consist of one or more of the following polymers:

- polyethers such as polyethylene oxide (PEO), polypropylene oxide (PPO) and random copolymers of ethylene oxide (EO) and of propylene oxide (PO),
- polyvinyl methyl ethers,
- polymeric N-substituted acrylamide derivatives such as poly-N-isopropylacrylamide, poly-N-ethylacrylamide and copolymers of N-isopropylacrylamide or of N-ethylacrylamide and of a vinyl monomer corresponding to formula (I) given in Claim 9, or of a monomer chosen from maleic anhydride, itaconic acid, vinylpyrrolidone, styrene and its derivatives, dimethyldiallylammonium chloride, vinylacetamide, vinyl ethers and vinyl acetate derivatives; and
- polyvinylcaprolactam and copolymers of vinylcaprolactam and of a vinyl monomer corresponding to formula (I) given in Claim 9, or of a monomer chosen from maleic anhydride, itaconic acid, vinylpyrrolidone, styrene and its derivatives, dimethyldiallylammonium chloride, vinylacetamide, vinyl ethers and vinyl acetate derivatives.

30. Emulsion according to any one of Claims 23 to 28, in which the units with an LCST consist of polypropylene oxide of formula  $(\text{PPO})_n$  with  $n$  being an integer from 10 to 50, or random copolymers of ethylene oxide (EO) and of propylene oxide (PO), represented by the formula:



in which  $m$  is an integer ranging from 1 to 40 and preferably from 2 to 20, and  $n$  is an integer ranging from 10 to 60 and preferably from 20 to 50.

31. Emulsion according to Claim 30, in which the molar mass of the units with an LCST is from 500 to 5300 g/mol and preferably from 1500 to 4000 g/mol.

32. Emulsion according to Claim 29, in which the units with an LCST consist of poly-N-isopropylacrylamide or poly-N-ethylacrylamide or a copolymer of N-isopropylamide or of N-ethylacrylamide and of a monomer corresponding to formula (I) given in Claim 9, or of a monomer chosen from maleic anhydride, itaconic acid, vinylpyrrolidone, styrene and its derivatives, dimethyldiallylammonium chloride, vinylacetamide, vinyl alcohol, vinyl acetate, vinyl ethers and vinyl acetate derivatives.

33. Emulsion according to Claim 32, in which the molar mass of the units with an LCST is from

1000 g/mol to 500 000 g/mol and preferably from 2000 to 50 000 g/mol.

- 5 34. Emulsion according to any one of Claims 23 to 28, in which the units with an LCST consist of a polyvinylcaprolactam or a copolymer of vinylcaprolactam and of a vinyl monomer corresponding to formula (I) given in Claim 9, or of a monomer chosen from maleic anhydride, 10 itaconic acid, vinylpyrrolidone, styrene and its derivatives, dimethyldiallylammonium chloride, vinylacetamide, vinyl alcohol, vinyl acetate, vinyl ethers and vinyl acetate derivatives.
- 15 35. Emulsion according to Claim 34, in which the molar mass of the units with an LCST is from 1000 to 500 000 g/mol and preferably from 2000 to 50 000 g/mol.
- 20 36. Emulsion according to any one of Claims 23 to 35, in which the proportion by mass of the units with an LCST of the polymer is from 5 to 70%, preferably from 20 to 65% and better 25 still from 30 to 60% relative to the polymer.
- 30 37. Emulsion according to any one of Claims 23 to 36, in which the demixing temperature of the units with an LCST is from 5 to 40°C for a concentration of the units with an LCST in water of 1% by mass.
38. Emulsion according to any one of Claims 23 to 37, in which the concentration by mass of

polymer in the aqueous phase is less than or equal to 5% and preferably from 0.01% to 5%.

- 5 39. Emulsion according to any one of Claims 23 to 38, in which the aqueous phase also comprises an emulsifying surfactant at a concentration not exceeding 1%.
- 10 40. Emulsion according to any one of Claims 23 to 39, also comprising a gelling agent.
- 15 41. Cosmetic use of the foaming composition according to any one of Claims 7 to 22, for cleansing and/or removing make-up from the skin, including the scalp, the nails, the hair, the eyelashes, the eyebrows, the eyes, mucous membranes and semi-mucous membranes, and any other area of body or facial skin.
- 20 42. Cosmetic use of a cosmetic emulsion according to any one of Claims 23 to 40, for treating, caring for, protecting and/or making up facial skin and/or body skin, mucous membranes (lips), the scalp and/or keratin fibres.
- 25 43. Cosmetic process for cleansing and/or removing make-up from the skin, the scalp and/or the hair, characterized in that the composition of the invention is applied to the skin, to the scalp and/or to the hair, in the presence of
- 30 water, and the foam formed and the soiling residues are removed by rinsing with water.